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Application No.	980996
Date of Filing	1 December 1998
Applicant	NEW LAKE INTERNATIONAL LIMITED, an Irish company of c/o Woods Sweetman & Co., Bridge Street, Balbriggan, County Dublin, Ireland.

Dated this 13 day of June 2001.

pp An officer authorised by the
Controller of Patents, Designs and Trademarks.

FORM NO. 1 [redacted] [redacted] E980996

REQUEST FOR THE GRANT OF A PATENT

PATENTS ACT, 1992

The Applicant(s) named herein hereby request(s)

__X__ the grant of a patent under Part II of the Act

_____ the grant of a short-term patent under Part III of the Act

on the basis of the information furnished hereunder.

1. Applicant(s)

Name NEW LAKE INTERNATIONAL LIMITED

Address c/o Woods Sweetman & Co
Bridge Street
Balbriggan
County Dublin
Ireland

Description/Nationality

An Irish company

2. Title of Invention

"Tank lining"

3. Declaration of Priority on basis of previously filed application(s) for same invention (Sections 25 & 26)

Previous filing date	Country in or for which filed	Filing No.

4. Identification of Inventor(s)
Name(s) of person(s) believed
by Applicants(s) to be the inventor(s)

Name: Fergus Rupert Fitzgerald, an Irish citizen
Address: 330 Marina Village, Malahide, County Dublin, Ireland.

[redacted] [redacted] 990098

5. Statement of right to be granted a patent (Section 17(2) (b)

The Applicant derives the right to the Invention by virtue of a Deed of Assignment dated November 30, 1998.

6. Items accompanying this Request – tick as appropriate

(i) __X__ Prescribed filing fee (£100.00)

(ii) __X__ Specification containing a description and claims

_____ Specification containing a description only

__X__ Drawings referred to in description or claims

(iii) _____ An abstract

(iv) _____ Copy of previous application (s) whose priority is claimed

(v) _____ Translation of previous application whose priority is claimed

(vi) __X__ Authorisation of Agent (this may be given at 8 below if this Request is signed by the Applicant(s)

7. Divisional Application (s)

The following information is applicable to the present application which is made under Section 24 –

Earlier Application No: .....

Filing Date: .....

8. Agent

The following is authorised to act as agent in all proceedings connected with the obtaining of a patent to which this request relates and in relation to any patent granted -

Name	Address
John A. O'Brien & Associates	The address recorded for the time being in the Register of Patent Agents, and currently Third Floor, Duncairn House, 14 Carysfort Avenue, Blackrock, Co. Dublin, Ireland.

9. Address for Service (if different from that at 8)

As above

Signed _____ JOHN A. O'BRIEN & ASSOCIATES

Date December 1, 1998

"TANK LINING"

Introduction

The invention relates to a method for lining a storage tank, especially underground storage tanks for petroleum products and chemicals generally.

Statements of the Invention

According to the invention there is provided a method of lining a storage tank comprising the steps of: -

providing a keying means on the inner surface of the tank;

applying a corrosion barrier coating to the keying means;

applying an interstitial grid to the tank;

laying up a pliable glass reinforced plastics material onto the grid; and

exposing the glass reinforced plastics material to ultra violet rays to cure the material and form a hardened inner liner shell for the tank.

In a preferred embodiment of the invention the interstitial grid is provided by pre-formed sheets of flexible plastics material.

Preferably the grid is adhesively banded to the corrosion barrier coating.

Ideally the grid has a facing material applied to receive the glass reinforced plastics material. Preferably the facing is a polyester mat banded to one side of the grid.

In a preferred arrangement the grid is of a plastics material. Ideally the grid is of high density polyethylene material.

In one embodiment of the invention the method includes the step of: -

applying a coating to the hardened GRP liner.

Preferably the keying means is provided by grit blasting the inner surface of the tank.

In one embodiment of the invention the method includes the step of: -

cleaning the inner surface of the tank prior to providing the keying means.

In a preferred embodiment the inner surface is cleaned by water jet cleaning.

Preferably the corrosion barrier is a glassflake epoxy resin.

Preferably the corrosion barrier layer is applied to a dry film thickness of greater than 1000 microns.

In one embodiment of the invention the method includes the steps, prior to application of a corrosion layer of: -

inspecting the internal wall of the tank; and

repairing any imperfections in the tank wall.

Preferably the GRP is exposed to UV by directing UV lamps at the GRP layer.

In a preferred arrangement the GRP material is covered with an outer protective film which is removed to expose the GRP material to UV.

Preferably the coating is a glassflake epoxy resin.

In one embodiment of the invention the tank is an underground liquid storage tank.

Preferably the method includes the step of controlling the environment in the tank, during lining.

In a preferred embodiment of the invention the temperature within the tank is maintained at a minimum target temperature of 15°C.

Preferably the relative humidity is maintained at less than 80% during lining. Ideally the relative humidity is maintained at from 50% to 60%.

The invention also provides a tank whenever lined by a method of the invention.

Brief Description of Drawings

The invention will be more clearly understood from the following description thereof given by way of example only with reference to the accompanying drawings, in which: -

Fig. 1 is a perspective partially cut-away view of a typical tank to be lined using the method of the invention;

Fig. 2 is a perspective partially cross sectional view of a tank lined by the method of the invention; and

Fig. 3 is a diagrammatic view of the tank of Fig. 2 in use.

Detailed Description

Referring to the drawings there is illustrated in Fig. 1 a typical underground tank 1 for storage of petroleum products and chemicals generally. The tank 1 may, for example, be an underground petroleum products storage tank located at a service station.

The storage tank 1 is lined by first cleaning the inner surface 2 of tank wall using water jetting to remove scale, rust and surface contaminants. The tank internal wall is then inspected to ascertain any leak areas or perforations. A full inspection of the tank is carried out using an ultrasonic wall thickness gauge to establish any internal/external corrosion patterns. Any resultant defects are repaired using an epoxy filler. Where necessary the striker plate, which is a steel plate below the manhole, is removed. Weld spatters, laminations etc may be removed by grinding.

A keying means is then provided on the inner surface of the tank. This is achieved by grit blasting using re-usable chilled iron grit.

A corrosion barrier coating 5 is then applied to the keying means. The coating 5 is a glassflake epoxy resin which is applied to a minimum dry film thickness of 1000 microns, typically using airless spray equipment. On completion of the corrosion barrier the integrity of the barrier is tested to identify any pinholes on the lining substrate.

An adhesive is applied to the corrosion barrier coating 5. Sheets of high density polyethylene (HDPE) interstitial grid 10 are bonded to an adhesive applied to the coating 5, forming an air gap which is typically about 5 mm. The grid 10 has a

polyester mat bonded to one side and the grid 10 is installed with the mat 11 facing into the tank.

A pliable glass reinforced plastics layer 16 is laid up onto the HDPE grid 10.

The GRP material used is an ultra violet (UV) light curable material in a sheet form. A matrix of isophthalic resin, e-type glass reinforcement, inert fillers and a photo-initiator is sandwiched between two nylon films. The nylon films minimise emissions and facilitate handling and shaping. A further protective film to protect against daylight exposure is provided.

The GRP material has a styrene content of approximately 6% which substantially reduces emissions of volatile organics from the product.

The GRP material is first cut to size from a roll. The inner protective film is removed and the GRP is applied to the prepared surface, ensuring a minimum overlap of 50 mm at the joints between adjacent GRP sheets. The GRP material is smoothed and moulded to form an internal tank shell.

The outer UV protective layer is then removed from the GRP layer which is exposed to UV rays to cure the material and to form a hardened inner liner shell for the tank. In the case of an underground tank the GRP material is exposed to high powered UV lamps until it has fully cured resulting in a strong impermeable and hygienic shell within the tank 1. The curing time is generally a maximum of 60 minutes and is usually less than 30 minutes.

A suitable coating layer 7 may then be applied to the cured GRP layer 6. Preferably the barrier coating is a glassflake epoxy which is applied to a minimum dry film thickness of 1000 microns using airless spray equipment.

An ultrasonic leak monitoring transducer 20 is installed in the interstitial space at lower section of the tank.

A vapour monitor sampling tube 21 is also installed in the interstitial space at the lower section of the tank.

All cables and the sampling tube are fed through a predrilled aperture, adjacent to the tank manway flange, the cables and sampling tube are bedded in Epoxy and shrouded with strips of the GRP material described above.

The transducer 20 and vapour monitor sampling tube 21 are connected to a control box 25, located in a designated safe area. An audible and/or visual alarm are connected to the control box 25.

Should liquid or vapour be detected within the interstitial space a signal is sent to the control box 25 which will set off both audible and visual alarms. On the initiation of the alarm an auto-time counter will begin to record the detection period.

Conditions inside the tank are artificially controlled to maintain a target temperature (minimum) 15°C throughout the application. A relative humidity 50%-60% average (maximum 80%) is also maintained. On completion of various stages, temperature will be elevated to +30°C to accelerate cure.

Environmental readings are taken every four hours. These readings will consist of air temperature, surface temperature, percentage relative humidity and dew point. Results are recorded and monitored.

On completion lining the new tank shell is pressure tested in accordance with BS 4994 : 1987 Specification for design and construction of vessels and tanks in reinforced plastics.

The invention provides a method of tank lining which is extremely effective and efficient both in terms of material costs and installation costs.

Many variations on the specific embodiment of the invention will be readily apparent and accordingly the invention is not limited to the embodiments hereinbefore described which may be varied in construction and detail.

CLAIMS

1. A method of lining a storage tank comprising the steps of: -

providing a keying means on the inner surface of the tank;

applying a corrosion barrier coating to the keying means;

applying an interstitial grid to the tank;

laying up a pliable glass reinforced plastics material onto the grid; and

exposing the glass reinforced plastics material to ultra violet rays to cure the material and form a hardened inner liner shell for the tank.

2. A method as claimed in claim 1 wherein the interstitial grid is provided by pre-formed sheets of flexible plastics material.

3. A method as claimed in claim 1 or 2 wherein the grid is adhesively banded to the corrosion barrier coating.

4. A method as claimed in any preceding claim wherein the grid has a facing material applied to receive the glass reinforced plastics material.

5. A method as claimed in claim 4 wherein the facing is a polyester mat bonded to one side of the grid.

6. A method as claimed in any preceding claim wherein the grid is of a plastics material.

7. A method as claimed in claim 6 wherein the grid is of high density polyethylene material.

8. A method as claimed in any preceding claim including the step of: -

applying a coating to the hardened GRP liner.

9. A method as claimed in any preceding claim wherein the keying means is provided by grit blasting the inner surface of the tank.

10. A method as claimed in any preceding claim including the step of: -

cleaning the inner surface of the tank prior to providing the keying means.

11. A method as claimed in claim 4 wherein the inner surface is cleaned by water jet cleaning.

12. A method as claimed in any preceding claim wherein the corrosion barrier is a glassflake epoxy resin.

13. A method as claimed in claim 6 wherein the corrosion barrier layer is applied to a dry film thickness of greater than 1000 microns.

14. A method as claimed in any preceding claim including the steps, prior to application of a corrosion layer of: -

inspecting the internal wall of the tank; and

repairing any imperfections in the tank wall.

15. A method as claimed in any preceding claim wherein the GRP is exposed to UV by directing UV lamps at the GRP layer.

16. A method as claimed in any preceding claim wherein the GRP material is covered with an outer protective film which is removed to expose the GRP material to UV.

17. A method as claimed in any of claims 2 to 10 wherein the coating is a glassflake epoxy resin.

18. A method as claimed in any preceding claim wherein the tank is an underground liquid storage tank.

19. A tank lining method substantially as hereinbefore described with reference to the accompanying drawings.

20. A tank whenever lined by a method as claimed in any preceding claim.

21. A tank as claimed in claim 20 including a leak monitoring transducer in the interstitial space defined by the grid.

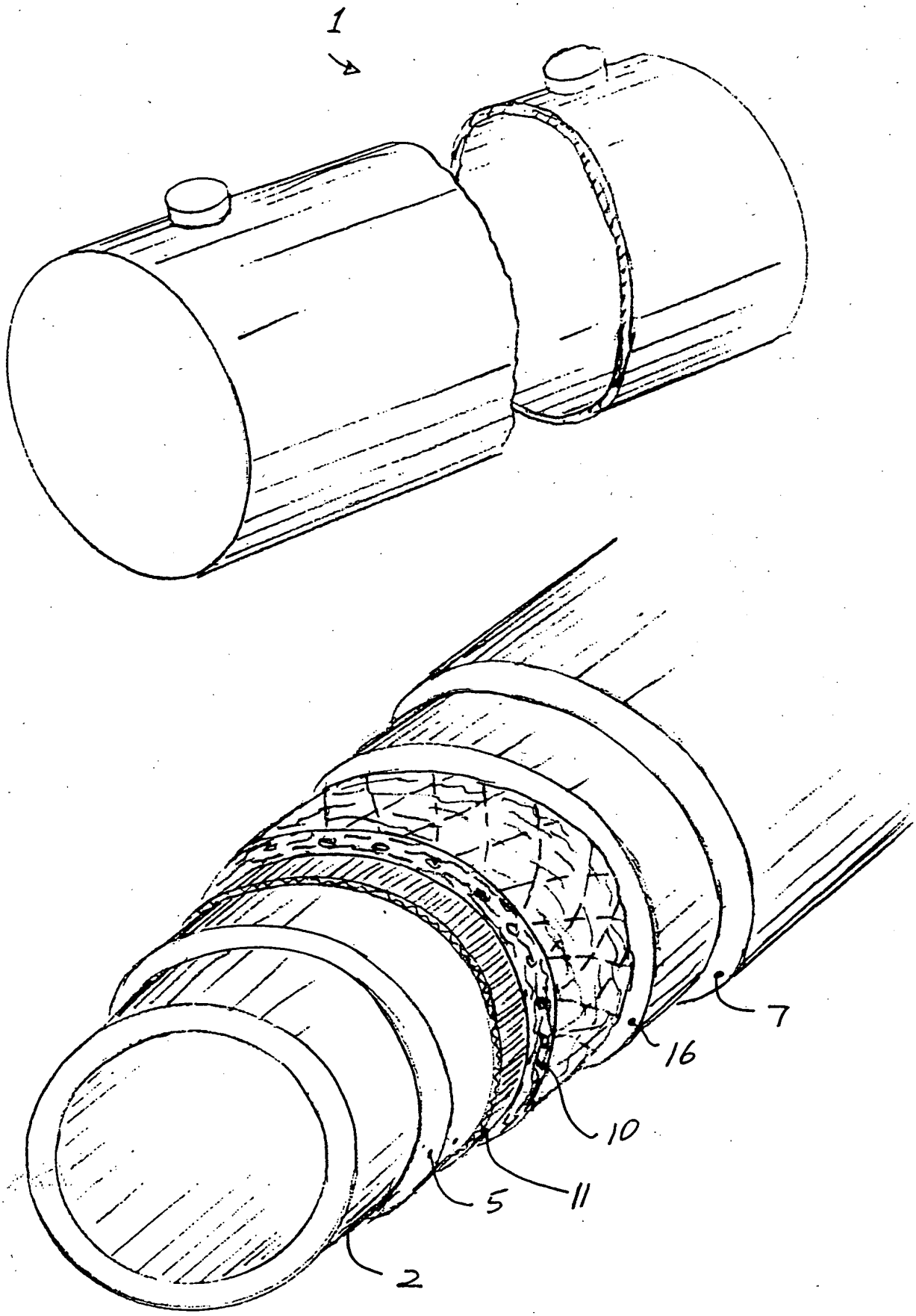
22. A tank as claimed in claim 20 or 21 including a vapour monitoring means in the interstitial space defined by the grid.

23. A tank as claimed in claim 22 wherein the vapour monitoring means includes a vapour sampling tube.

24. A tank as claimed in any of claims 21 to 23 including an alarm means associated with the monitoring means.

25. A tank as claimed in claim 24 wherein the alarm is mounted remote from the tank.

26. A tank substantially as hereinbefore described with reference to the accompanying drawings.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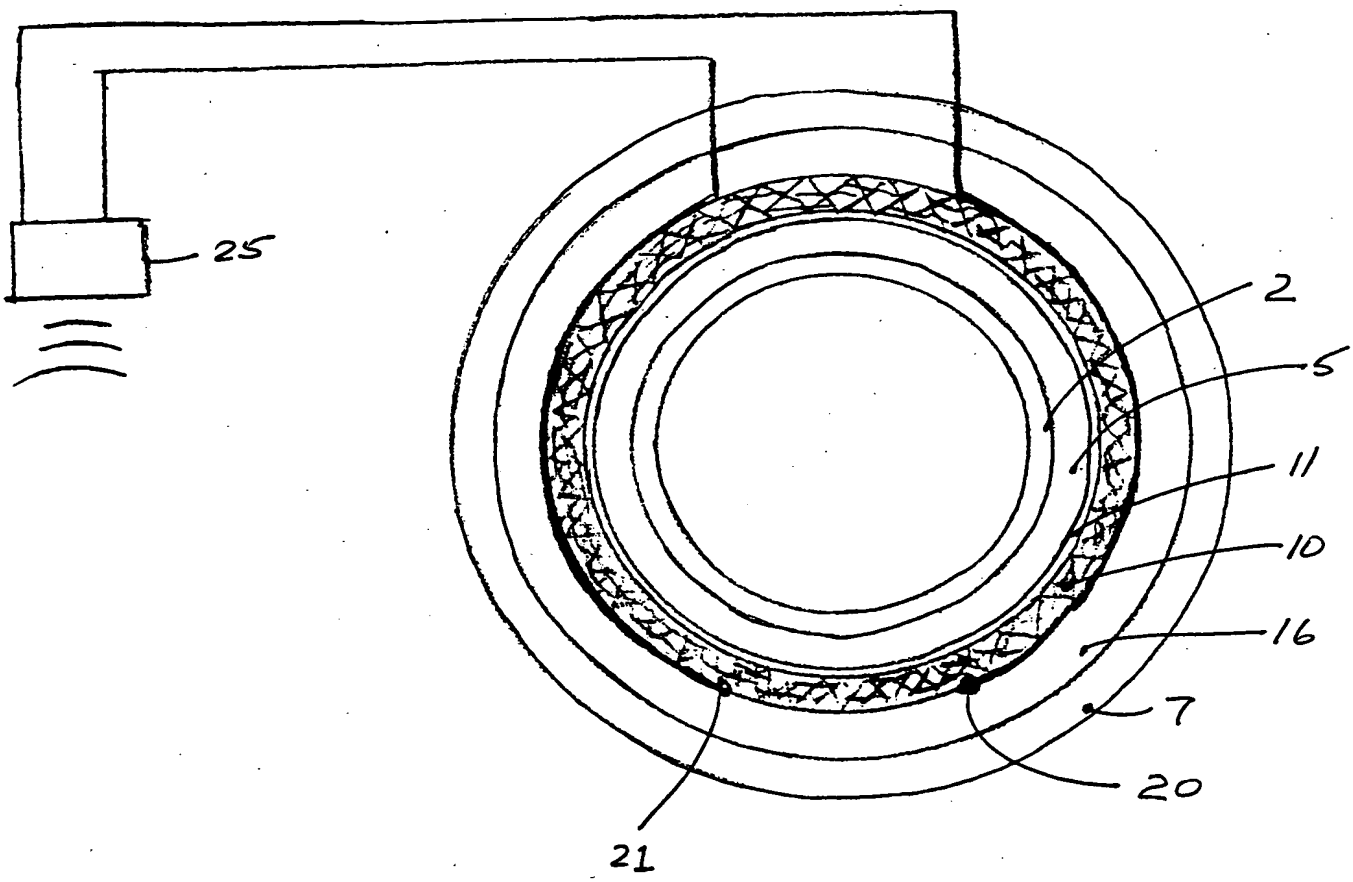
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